

“Siam Cement Biomass Project”



By

Document Prepared By: KBS Certification Services Pvt. Ltd.

Project Title	Siam Cement Biomass Project
Version	02
Report ID	VCS.17.VER.011-MP-01

Report Title	Siam Cement Biomass Project
Client	South Pole Carbon Asset Management Ltd.
Pages	55
Date of Issue	13-September-2018
Prepared By	KBS Certification Services Pvt. Ltd.
Contact	Registered Office: 414-424, Om Shubham Tower, Neelam-Bata Road, N.I.T., Faridabad-121001, Haryana India. Contact us at: Tel.: +91-129-4034513, 4054513, 403513, Fax: +91-129-4035139. Webpage: www.kbsindia.in.
Approved By	Kaushal Goyal, Managing Director
Work Carried Out By	Team Leader: Chetan Swaroop Sharma (TA 1.1, 13.1) Team Member: Rohit Badaya (TA 1.1, 13.1) Technical Expert: Anil Kumar Pandey (TA 4.1) Local Expert: Siam Phoolcharoen Technical Reviewer: MP Kanal (TA 1.1, 13.1) and Rajpal Singh (TA 4.1) Manager Technical and Certification: Sanjay Kandari

Summary:

KBS Certification Services Pvt. Ltd. has been contracted by, "South Pole Carbon Asset Management Ltd." to undertake independent periodic verification and certification for the greenhouse gas (GHG) emission reductions reported from 'Siam Cement Biomass Project' for the monitoring period 01/04/2016 to 30/06/2017 in the initial monitoring report version 01 dated 03/05/2018 /1/, with regard to the relevant requirements of VCS Standard Version 3.7 /16/17/.

The project was validated (by Bureau Veritas Certification Holding SAS) and registered with reference no. 403 under VCS program on 03/11/2009 for the 1st crediting period (01/04/2006 to 31/03/2016). "KBS Certification Services Pvt. Ltd." performed the validation of renewable of the 2nd crediting period (01/04/2016 to 31/03/2026) of the project activity.

This is the 1st periodic verification of 2nd crediting period of this project which covers the period from 01/04/2016 to 30/06/2017 (including both the days). The project is verified against the VCS Version 3 /16/17/. The verification is based on the monitoring plan of revised/registered VCS Project Description Document (VCS PD) /11/, requirements of VCS (VCS Standard and VCS Program Guide of VCS Version 3) /16/17/ and CDM Validation and Verification Standard for project activities, version 01.0 /15/. The methodology applied for the project to estimate the GHG emission reductions is ACM0003 - "Partial substitution of fossil fuels in cement or quicklime manufacture" (version 08.0) /14/.

The verification is based on the revised/registered VCS PD, proof of title, proof of right, additional documents related to baseline and monitoring methodology; the subsequent background investigation, follow-up interviews and supporting documents made available to the verification team by project proponent.

Monitoring report (MR) /01/, Emission reduction calculation spread sheet (ER sheet) /02/, Project Description document (VCS PD) /11/ and other supporting documents have also been made available to the verification team.

A risk based approach has been followed to perform the verification of the project activity. In the course of verification, 01 Corrective Action Request (CAR) and 01 Clarification Request (CL) have been raised. All the CARs and CLs have been closed out successfully.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/04/2016 to 30/06/2017 based on the reported emission reductions in the final monitoring report Version 03 dated 12/09/2018 for the same period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

As a result of the verification, the verifiers confirm that the GHG emission reduction in the verification period from 01/04/2016 to 30/06/2017, including both the days, is **194,791 tCO₂e** /2/.

KBS confirms the following;

Reporting period: 01/04/2016 to 30/06/2017

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2016 (01/04/2016 to 31/12/2016)	164,348	58,321	0	106,027
2017 (01/01/2017 to 30/06/2017)	124,058	35,294	0	88,764
Total	288,406	93,615	0	194,791

Table of Contents

1	Introduction	6
1.1	Objective	6
1.2	Scope and Criteria	6
1.3	Level of Assurance.....	7
1.4	Summary Description of the Project	7
2	Verification Process	8
2.1	Method and Criteria.....	8
2.2	Document Review	9
2.3	Interviews	9
2.4	Site Inspections	10
2.5	Resolution of Findings.....	10
2.5.1	Forward Action Requests	12
2.6	Eligibility for Validation Activities	12
3	Validation Findings.....	12
3.1	Participation under Other GHG Programs	12
3.2	Methodology Deviations	12
3.3	Project Description Deviations	13
3.4	Grouped Project	14
4	Verification Findings.....	14
4.1	Project Implementation Status	14
4.2	Accuracy of GHG Emission Reduction and Removal Calculations	37
4.3	Quality of Evidence to Determine GHG Emission Reductions and Removals	39
4.4	Non-Permanence Risk Analysis.....	40

5	Safeguards.....	40
5.1	No Net Harm	40
5.2	Local Stakeholder Consultation	40
6	Verification Conclusion	40
	APPENDIX X:.....	42

1 INTRODUCTION

1.1 Objective

KBS has been commissioned by 'South Pole Carbon Asset Management Ltd.' to perform verification of its registered VCS project 'Siam Cement Biomass Project', for the reported GHG emission reductions for the given monitoring period 01/04/2016 to 30/06/2017 (both dates included). The VCS projects must undergo an independent third party verification and certification of emission reductions as the basis for issuance of Voluntary Emission Reductions (VERs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the project description (VCS PD) and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.
- To confirm that the monitoring system is implemented and fully functional to generate Voluntary Emission Reductions (VERs/VCUs) without any double counting, and
- To establish that the data reported are accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculations.

1.2 Scope and Criteria

The verification scope is defined as an independent and objective review of monitoring report /1/, VCS Project Description (VCS PD), including the monitored data and other relevant documents made available to verifier and information collected through performing interviews during on-site assessment of the project activity.

The project is assessed against the requirements of VCS Standard version 3.7 /17/ and related rules and guidance. KBS has, based on the recommendations in the latest version of Verified Carbon Standard, and employed a rule-based approach (as criteria) in the verification, focusing on the identification of significant reporting rules and the reliability of project monitoring.

The aspects to be covered under the purview of verification are:

- Ensure that the project activity has been implemented and operated as per the revised/registered VCS PD and that all physical features (technology, project equipment, and monitoring and metering equipment) /7/ of the project are in place as per the documents provided by the client and on-site visit.
- Ensure that the monitoring report /20/ and other supporting documents provided are complete.
- Ensure that the practiced monitoring system and procedures comply with the monitoring systems and procedures described in the monitoring plan and the approved CDM methodology;
- Evaluate the data recorded and stored are as per the monitoring methodology.

1.3 Level of Assurance

☒ Reasonable level of assurance

The verification report is based on monitoring report, VCS PD /11/, supporting documents and information collected, which are made available to the verifier through document review, interviews session and during the on-site assessment. The verification opinion is assured to provide the credibility of all above with reasonable level of assurance.

1.4 Summary Description of the Project

The project is a combination of five GHG reduction projects located in five different cement manufacturing units of SCG Cement Co., Ltd., in Thailand. All project activities in this group involve partial replacement of fossil fuels by alternative fuels or less carbon intensive fuels, including biomass, in kiln processing of cement manufacture. The proposed project activities involve the installation of storage and handling system for biomass residue. In order to implement the project activities a complete system for receiving, storing, and feeding alternative fuels and less carbon intensive fuels has been introduced.

Hence the purpose of the project activity is to improve waste management system, reduction of the dependence on fossil fuels and reduction of greenhouse gas emission through the decreasing of fossil fuel consumption. The partial substitution of fossil fuels with alternative fuels and less carbon intensive fuels allow reduction of the GHG emission from fossil combustion in kiln processing.

The proposed grouped project has been implemented at The Siam Cement (Ta Luang) Co., Ltd. (Ta Luang Cement Plant and Khao Wong Cement Plant), The Siam Cement (Kaeng Khoi) Co., Ltd., The Siam Cement (Thung Song) Co., Ltd., and The Siam Cement (Lampang) Co., Ltd. SCG Cement Co., Ltd. has 100% shareholding in these five companies. Although there are 5 different sites, the primary site appeared in the VCS project database is 'The Siam Cement (Kaeng Khoi) Co., Ltd.' with unique coordinate at 14°36'33.59"N 100°59'46.88"E.

According to Voluntary Carbon Standard Program Guidelines, clause 5.2 (Group Projects), the central GHG information system and controls associated with the project and its monitoring will response by SCG Cement Co. Ltd. As per VCS program guidelines (18 November 2008), the proposed grouped project is expected to reduce anthropogenic emissions by sources within 5,000 – 1,000,000 tonnes of carbon dioxide equivalent annually.

Verification team has checked the project activity equipments installed at the project site and found in compliance with the revised/registered VCS PD /11/.

The project sites are located in different areas of the Thailand. Three of them are located in Saraburi province: Kaeng Khoi District, Ban Kor District and Phaputtabat District, approximately 120 km north of Bangkok. One project site is situated in Lampang province, approximately 600 km to the north of Bangkok. The remaining project site is located in Nakon Si Thammarat province, approximately 835 km to the south of Bangkok.

The geo-coordinates of the project site are: The Siam Cement (Kaeng Khoi): 14° 36' 33.59"N & 100° 59' 46.88"E, The Siam Cement (Ta Luang): 14° 34' 10.00"N & 100° 45' 56.10"E, The Siam

Cement (Khao Wong): 14° 45' 08.56"N & 100° 47' 15.21"E, The Siam Cement (Lampang): 18° 33' 22.66"N & 99° 34' 23.08"E, The Siam Cement (Thung Song): 8° 6' 1.20"N, 99° 41' 2.50"E.

During the 2nd crediting period, the four sites from five sites of this bundle, have been excluded from the emission reduction calculations as follows;

- The Siam Cement (Lampang): design change from the installation of gasifier;
- The Siam Cement (Kaeng Khoi): design change from the installation of solid waste pre-treatment unit;
- The Siam Cement (Ta Luang) at Ta Luang and Khao Wong sites: stop using biomass due to high biomass price and difficulty of biomass supply sourcing.

Therefore, there is only "The Siam Cement (Thung Song)", which is still applicable to claim the emission reductions from this bundle of project activities in the second crediting period.

The project 2nd crediting period is from 01/04/2016 to 31/03/2026, Hence the monitoring period selected for 1st periodic verification of the second crediting period i.e. 01/04/2016 to 30/06/2017 is within the 2nd crediting period.

The total emission reduction for 1st monitoring period (2nd crediting period) from 01/04/2016 to 30/06/2017 is 194,791 tCO₂e. The emission reductions are calculated conservatively as per the applied methodology.

Project entity information is presented below:

Item	Data
Project Entities	The Siam Cement (Kaeng Khoi) Co.,Ltd. 33/1 Moo3, Tambon Ban Pa, Kaeng Khoi District, Saraburi, 18110, Thailand
	The Siam Cement (Ta Luang) Co.,Ltd. 1 Moo 9, Tambon Ban Krao, Ban Mor District, Saraburi, 18270, Thailand
	The Siam Cement (Khao Wong) Co.,Ltd. 28 Moo 9, Tambon Khaowong, Phraputtabat District Saraburi 18120, Thailand
	The Siam Cement (Lampang) Co.,Ltd. 279 Moo 5, Tambon Bansa, Chaehom District, Lampang ,52120, Thailand
	The Siam Cement (Thung Song) Co.,Ltd. 52 Moo 6, Tambon Teewang, Thung Song District, Nakon Si Thammarat, 80110, Thailand
	South Pole Carbon Asset Management Ltd. Technoparkstrasse 1 , Zurich , Switzerland 8005

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification process was carried out inline with the requirements VCS Version 3 /17/. In addition, the verification team followed the guidelines of the CDM Validation and Verification Standard for project activities, version 01.0 /15/. Standard auditing techniques and KBS's CDM Procedures were also applied during the verification. A risk-based approach was followed to carry

out the verification and access all the factors and concerns that relate to the issuance of emission reductions from a project activity.

They include:

- Identification of all the sources contributing to the baseline emissions, project emissions and emission reductions.
- Authenticity of the provided data is checked.
- A risk based analysis is carried out to ensure a clear and transparent assessment. The risks involved in this process are mainly with the informational flows and data recording.

KBS follows a risk based verification approach, wherein a desk review of the project documentation is undertaken, which is followed by an onsite visit by the members of verification team. The verification protocol is filled by the verification team that is based on standard auditing practices and VCS requirements. The verification protocol provides transparent means to record the observations by the verification team members and the non-conformities, if any. The verification protocol is an internal document, and available on request.

Duration of Verification:

Verification Contract	21/09/2017
On site verification	02/10/2017 to 04/10/2017
Findings raised	27/08/2018
Draft Verification Report	01/09/2018
Final Verification Report	13/09/2018

2.2 Document Review

A desk review is undertaken, involving but not limited to,

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The list of document reviewed is included in the Appendix 2: 'References'

2.3 Interviews

The site visit for this verification assessment was undertaken by the members of the assessment team. Summary of the on-site visit activities are mentioned below;

Location	Thung Song, Nakon Si Thammarat, Thailand Khao Wong, Saraburi, Thailand Ta Luang, Saraburi, Thailand
Dates	02/10/2017 to 04/10/2017
Key points discussed	Name of persons interviewed, Designation, Organization
• General aspects of the project • Project equipment operation and technical details • Changes since validation	Santosh K. Singh, Regional Director, South Pole Carbon Asset Management Ltd. Nattaya Lonawan, Project Manager, South Pole

• Monitoring and measurement equipment • Remaining issues from previous verification • Calibration procedures • Quality management system • Involved personnel and responsibilities • Training and practice of the operational personnel • Implementation of the monitoring plan • Monitoring data management • Data uncertainty and residual risks • GHG calculation • Maintenance	Carbon Asset Management Ltd. Kanitpoom Piboonnurak, Site Engineer, SCG Pipat Kussalerdjarjya, Laboratory section, SCG Oubonrat Kabounsarn, Laboratory section, SCG Panuwat Naruebarn, Production section, SCG Sirinut Raya, Project Manager, South Pole Carbon Asset Management Ltd. Yulta Dobrolyubova, Expert, South Pole Carbon Asset Management Ltd. Pollaphat Pornpitakthum, Engineer, SCG Patiphan Kurustien, Engineer, SCG Attaporn Matae, Engineer, SCG
---	---

2.4 Site Inspections

A site visit is undertaken by members of verification team, involving but not limited to,

- An assessment of the implementation and operation of the project activity as per the revised/registered VCS PD;
- A review of information flows for generating, aggregating and reporting the monitoring parameters;
- Interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the approved monitoring plan;
- A cross-check between information provided in the monitoring report and data from other sources such as plant log books, inventories, purchase records or similar data sources;
- A check of the monitoring equipments including calibration performance and observations of monitoring practices against the requirements of the revised/registered VCS PD /11/ and the selected methodology /14/;
- A review of calculations and assumptions made in determining the GHG data and emission reductions;
- An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

KBS applies the risk based approach aimed at focusing on high risk issues to the verification results whilst not omitting any part of the mandatory processes. A few discrepancies were found during the verification and the draft verification report was submitted to the project proponent, indicated under the titles corrective action requests (CARs) and clarification requests (CLs). CARs and CLs require the PP to take relevant actions. Criteria for judging items as CAR or CL are as follows:

Corrective action request (CAR):

- the project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions
- the Verified Carbon Standard's requirements have not been met, or
- there is a risk that emission reductions cannot be monitored or calculated.

Clarification request (CL):

- Information is insufficient or not sufficiently clear to determine whether the applicable VCS requirements have been met.

FARs is to be raised to highlight issues related to project implementation that require review during the first or subsequent verification of the project activity. FARs does not relate to VCS requirements for registration.

CARs and CLs are to be resolved or closed out if the PP modifies the project description, rectifies the Monitoring report or provides adequate additional explanations or evidence that satisfies the concerns. If this is not completed, the project activity cannot be recommended for issuance under VCS registry.

The monitoring report document was revised addressing the CARs & CLs issued by KBS. After reviewing the revised and resubmitted monitoring report /1/; resolving the CARs & CLs raised and outstanding concerns, KBS issues this final verification report and opinion.

01 CAR and 01 CL were found during verification and closed satisfactorily. The list of CARs/CLs raised and the response provided, the means of verification, reasons for their closure and references to correction in the MR are provided in Appendix 4 of this report. The revised MR with changes incorporated as per the issues raised were rechecked with the documentary evidences and found to be inline.

2.5.1 Forward Action Requests

No FAR was raised during this monitoring period, neither there was any remaining FAR from the previous validation/verification that needs to be addressed during this current verification.

2.6 Eligibility for Validation Activities

KBS conduct the current verification activity and the project was validated by other VVB during the 1st crediting period (01/04/2006 to 31/03/2016) and a separate validation report issued and approved by the VCS association. "KBS Certification Services Pvt. Ltd." performed the validation of renewable of the 2nd crediting period (01/04/2016 to 31/03/2026) /12/ of the project activity. The validation report of renewable of the 2nd crediting period is publicly available on the v-c-s.org website at link:

http://www.vcsprojectdatabase.org/#/project_details/403

KBS has a valid UNFCCC accreditation in the required sectoral scopes from the UNFCCC.

3 VALIDATION FINDINGS

No Validation findings. Refer above section.

3.1 Participation under Other GHG Programs

PP does not apply for other GHG program as declared in the revised/registered VCS PD.

3.2 Methodology Deviations

As result of this current verification, it was found that there is a methodology deviation applied to the project activity as per following,

Methodology Deviation is applicable when monitoring practices of some parameters in this monitoring period has been deviated from applied methodology. Verification team verified the justification from Project Proponent and the description of the deviation and the assessment on conservativeness of the deviation is provided below.

Deviation: P_{clinker} (Production of clinker in year y)

Description of the deviation
The $P_{\text{clinker},y}$ is not monitored by the weight feeder.
Explanation of the deviation
The daily clinker production is calculated from the amount of raw meal and clinker factor. The summary of daily clinker production in a month is adjusted by the stock checking data at the end of month and reported in the Work Journal /5/.
Compliance with the deviation
Since the amount of clinker production cannot be directly measured because of its high temperature. The amount the raw meal which is directly measured by weight feeder and the clinker factor is used for calculating the clinker production. - The amount of raw meal is continuously monitored by the weight feeder and the data is recorded on daily basis. - The clinker factor is from the result of LOI (Lost of Ignition), % ash, % dust loss and moisture content from internal laboratory.

- The amount clinker produced in the stock checking report is from the truck scale and the available stock of clinker in the cement factory.
- The calculated amount of clinker produced is cross-checked and adjusted with the stock checking information on monthly basis to ensure the accuracy of the figures presented in the Work Journal /5/.

This approach can improve the accuracy and reliability of monitoring data measured from monitoring devices. It was also applied for previous verifications and does not impact the applicability of the methodology, additionality or the appropriateness of the baseline scenario

Assessment by the verification team

The deviation has been transparently described in Section 2.2.1 of the MR.

Due to the fact that hot clinker is not possible to be directly weighted by any weighting machine because of their extremely high temperature, in doing so, verification team had verified the Work Instruction (W-P-W1-001) on how calculation of clinker had been made. It's found that quantity of clinker came from several input parameters such as, (a) Loss on Ignition (LoI), (b) % Ash, (c) % Dust loss and (d) Moisture content in raw material. Based on evidences found during document review and onsite visit, it's found that these parameters had been analyzed by well calibrated equipment (e.g., furnace, oven, 4-digit weighing machines) which are in line with their internal laboratory procedures. In addition, annual total quantity of clinker produced had taken account of amount of raw material consumed, which also continuously measured by well-calibrated weighing feeder. With cross-checking between analyzed data from laboratory and data aggregated in daily log sheet & work journal, verification team didn't find any discrepancy larger than 5% material threshold. Instead of applying default clinker produced, verification team accepted the justification from Project Proponent that using data from well calibrated equipment & qualified laboratory is not negatively affect the conservativeness but also increasing quantification's accuracy. This is also permitted by VCS rules and requirements /16/17/19/.

The verification team is of the opinion that the approach followed by the PP is appropriately described and justified and the project remains in compliance with the VCS rules. In conclusion, verification team accepted this deviation on the basis that using reliable calculation methods from well calibrated and relevant weighing machines are resulting in greater quantification accuracy.

The deviation does not overestimate the emission reductions and hence accepted to the verification team. Hence the deviation is accepted.

3.3 Project Description Deviations

Not Applicable as there is no project description deviations to be applied in this monitoring period.

3.4 Grouped Project

Not Applicable

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The project activity is in operation stage as evidenced by the physical verification of the project site.

During the 2nd crediting period, the four sites from five sites of this bundle, have been excluded from the emission reduction calculations as follows;

- The Siam Cement (Lampang): design change from the installation of gasifier;
- The Siam Cement (Kaeng Khoi): design change from the installation of solid waste pre-treatment unit;
- The Siam Cement (Ta Luang) at Ta Luang and Khao Wong sites: stop using biomass due to high biomass price and difficulty of biomass supply sourcing.

The same is in line with the revised VCS PD. All the physical components /3/4/10/ and project boundary are in conformity with the description in the revised VCS PD /11/. The capacity of project equipments have been cross-checked during the on-site visit and found in-compliance with the revised VCS-PD /11/. On the basis of the on-site visit and the reviewed project documentation, the verification team confirms that the project was implemented and operated as described in the revised VCS PD /11/.

There is one deviation which has been addressed in the Section 3.2 of this verification report and has been assessed by the verification team.

Ownership and other programs:

The PP has declared that the project is not registered under any other mechanism apart from VCS. Thus emission reductions generated by project will be solely claimed by PP and PP has right of use and hence accepted. Net GHG emission reductions or removals generated by this project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions as the host country i.e. Thailand is not a participant in any emission trading programs or nor does it have any binding limits.

PP will not claim the carbon credits under any other GHG emission reduction scheme for the crediting period under VCS and PP has provided declaration on the same during the validation. Hence there is no possibility of double counting. Apart from VCS, it has neither applied nor been rejected under any other GHG program.

Management and operational system:

Verification team was able to verify that authorities and responsibilities for monitoring and reporting of all data related to the emission reductions were clearly defined for the monitoring period from 01/04/2016 to 30/06/2017.

The allocation of the responsibilities is documented in a written form and is followed as described in the revised/registered VCS PD. Routines for the archiving of data are defined and documented. During the site visit all the required plant records were verified and found that the data is consistent with that provided in the final MR /01/ and ER sheets /02/.

The monitoring plan described in Section 3.3 of the MR is confirmed to be correct. All the parameters of the monitoring plan are monitored using appropriate metering system.

The verification team has interviewed the plant personnel who are involved in the monitoring of the parameters that are used to determine the emission reductions of the VER project. It is confirmed based on the interviews that the plant's team is competent enough to monitor the parameters as described in the monitoring plan.

As discussed above, the verification team concludes that management and operational system of the project is implemented and operated well. Thus it ensures the quality of data which is required in calculating the emission reductions.

Implementation status of the monitoring plan:

Verification team confirms through on-site verification and from the document review, the actual monitoring system complies with the monitoring plan mentioned in the revised/registered VCS-PD.

During the verification, all relevant monitoring parameters of the registered monitoring plan have been verified with regard to the appropriateness of the verification method; the correctness of the values applied for ER calculation, the accuracy and applied QA/QC measures. All monitoring parameters have been measured / determined without material misstatements and are in line with all applicable standards and relevant requirements. It is confirmed that the monitoring mechanism is effective and reliable /6/. Wherever a parameter was not sufficiently monitored as per the monitoring plan of the VCS PD, a deviation was applied by the PPs and the emission reduction was calculated by a conservative approach.

Therefore, from the document review and onsite verification, it is confirmed that all the parameters were monitored in accordance with the revised/registered monitoring plan during the monitoring period. Following are the details of monitoring in accordance with the monitoring plan of the revised/registered VCS PD:

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$FC_{PJ,k,y}$ and $FC_{PJ,i,y}$ Quantity of alternative fuel or less carbon intensive fossil fuel type k ($FC_{PJ,k,y}$) and fossil fuel of type i ($FC_{PJ,i,y}$) used in the project plant in year y (tonnes)
Measuring frequency:	Continuously monitored and aggregated at least annually. The quantity of solid fossil fuel and biomass fuel is continuously monitored by weight scale equipment. The data from all inline measuring equipment is connected to Distributed Control System (DCS) at the control room /5/. The data recording from DCS is carried out by cell operator on daily basis. The fuel oil volume is continuously monitored by flow meter. The cell operators record the totalized flow at the flow meter before and after the operation of fuel oil supply pump. The measuring frequency is in line with the revised VCS PD.
Reporting frequency:	Continuously monitored and aggregated at least annually. The quantity of solid fossil fuel and biomass fuel is continuously monitored by weight scale equipment. The data recording from DCS is carried out by cell operator on daily basis.

	The fuel oil volume is continuously monitored by flow meter and the cell operators record the totalized flow at the flow meter before and after the operation of fuel oil supply pump. The daily monitored data is checked and adjusted with stock checking report at the end of month. The final figures are summarized in Work Journal (WJ) by engineer. The reporting frequency is in line with the VCS PD and the same was also verified during the on-site visit and found Ok.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the revised/registered VCS PD.
Type of monitoring equipment:	The quantity of solid fossil fuel and biomass fuel is continuously monitored by weight scale equipment. The fuel oil volume is continuously monitored by flow meter. The monitoring equipment details are provided in the Appendix 6 of the Verification Report. The monitoring equipment details have been checked during the site visit and found consistent.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class of the weighing scale equipment (for monitoring solid fossil fuel and biomass fuel) and flow meter (for monitoring fuel oil) is in compliance with the revised/registered VCS PD. Hence accepted to the verification team.
Calibration frequency /interval:	The monitoring equipment is calibrated according to the calibration plan /8/ and/or shutdown plan of kiln which is in compliance with the revised/registered VCS PD. The calibration details are provided under Appendix 6 of the Report. Hence accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been	The daily monitored data is checked and adjusted with stock checking report at the end of month. The final figures are

crosschecked with other available data?	summarized in Work Journal (WJ) by engineer.
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the Work Journal (WJ) /05/. The daily monitored data is checked with stock checking report at the end of month. The reported values in the MR and ER sheet were found to be consistent with the Work Journal (WJ) information /5/. The summary of values has been provided in the Appendix 5 of the Verification report.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The documentation and calibration is controlled and managed in accordance with ISO9001 requirements. The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$EF_{CO_2,k,y}$ and $EF_{CO_2,FF,i,y}$ Weighted average CO ₂ emission factor for alternative or less carbon intensive fuels of type k ($EF_{CO_2,k,y}$) and for fossil fuel of type i ($EF_{CO_2,FF,i}$) in year y (tCO ₂ /GJ)
Measuring frequency:	Not Applicable The data has been sourced from the IPCC default values /21/ or values provided by World Business Council for Sustainable Development /21/ are used.
Reporting frequency:	The data has been sourced from the IPCC default values /21/ or value provided by World Business Council for Sustainable Development ¹ /21/. The same was also verified during the on-site visit and found OK.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the revised/registered VCS PD.
Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If	Not Applicable.

¹ <http://wbcsdcement.org/index.php/key-issues/climate-protection/co2-accounting-and-reporting>

the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not Applicable
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	For fossil fuels - Option (d) has been used: IPCC default values at the upper/lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories /21/. For alternative fuels - Option (c) has been used: Regional or national default values. The source of emission factor is from the CO₂ Accounting and Reporting Standard for the Cement Industry², provided by World Business Council for Sustainable Development /21/. EF_{CO₂,k,y} is zero for the following alternative fuels: • Wastes originating from fossil sources where W1 has been identified as the most plausible baseline scenario; • Biomass residues; • Renewable biomass

² <http://wbcsdcement.org/index.php/key-issues/climate-protection/co2-accounting-and-reporting>

	The values mentioned in the monitoring report and ER sheet were verified with the IPCC default values or value provided by World Business Council for Sustainable Development /21/. The reported values in the MR and ER sheet were found to be consistent with the source of information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation								
Data / Parameter: (as in monitoring plan of the VCS PD):	$NCV_{k,y}$ and $NCV_{i,y}$ Weighted average net calorific value of the alternative or less carbon intensive fuel type k ($NCV_{k,y}$) and fossil fuel types i ($NCV_{i,y}$) in year y (GJ/tonne)								
Measuring frequency:	The following data sources may be used if the relevant conditions apply: <table border="1"> <thead> <tr> <th>Data source</th><th>Conditions for using the data source</th></tr> </thead> <tbody> <tr> <td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr> <tr> <td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr> <tr> <td>(c) Regional or national default values</td><td> If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances) </td></tr> </tbody> </table> For the options “values provided by the fuel supplier in invoices” and “measurements by the project participants”, the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. For the other option of “regional or	Data source	Conditions for using the data source	(a) Values provided by the fuel supplier in invoices	This is the preferred source	(b) Measurements by the project participants	If (a) is not available	(c) Regional or national default values	If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances)
Data source	Conditions for using the data source								
(a) Values provided by the fuel supplier in invoices	This is the preferred source								
(b) Measurements by the project participants	If (a) is not available								
(c) Regional or national default values	If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances)								

	national default values”, appropriateness of the values shall be reviewed annually.
Reporting frequency:	For option (a) and (b): the NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated. The fuel sample is analysed by internal laboratory. The results are saved in QIS (Quality Information System) by lab analyst. For option (c): appropriateness of the values is reviewed annually.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the revised/registered VCS PD.
Type of monitoring equipment:	Most of the fossil and biomass fuels are tested by internal laboratory for data source (b); The heating value of HFO is provided by supplier as per data source (a). The NCV /5/ is analysed according to the national or international approved standards and procedures through the internal laboratory.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Yes
Calibration frequency /interval:	The laboratory equipment is calibrated /8/ as per manufacturer's recommendation. Hence this is in compliance with the revised/registered VCS PD and accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet /2/ were verified with the QIS (Quality Information System) and invoices. The summary of value has been provided in the Appendix 5 of the Verification report. The reported values in the MR and ER sheet /2/

	were found to be consistent with the QIS (Quality Information System) information and invoices.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$P_{clinker,y}$ Production of clinker in year y (ton)
Measuring frequency:	The amount of raw material is continuously monitored. Referring to the methodology deviation as described in Section 3.2 of the Verification report, the quantity of clinker produced is calculated from amount of raw material with clinker factor and adjusting with stock checking report at the end of month. The final figures are summarized in WJ /5/.
Reporting frequency:	The amount of raw material is continuously monitored and reported on monthly basis and adjusting with stock checking report at the end of month. The quantity of clinker produced is calculated from amount of raw material with clinker factor and adjusting with stock checking report at the end of month. The final figures are summarized in WJ /5/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the revised/registered VCS PD.
Type of monitoring equipment:	The monitoring equipment details are provided in the Appendix 6 of the Report. The monitoring equipment details have been checked during the site visit and found consistent.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class of the measuring equipment is in compliance with the revised/registered VCS PD. Hence accepted to the verification team. The documentation and calibration is controlled and managed in accordance with ISO9001 requirements.
Calibration frequency /interval:	The monitoring equipment is calibrated according to calibration plan /8/ and/or shutdown plan of kiln. The documentation and calibration

	is controlled and managed in accordance with ISO9001 requirements Hence accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	The quantity of clinker produced has been cross checked with the Work Journal (WJ) /5/.
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the Work Journal (WJ) /05/. The summary of the values have been provided in the Appendix 5 of the Verification report. The reported values in the MR and ER sheet were found to be consistent with the Work Journal (WJ) /8/ information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EF _{CO2,BL,y} Carbon dioxide emissions factor for the fossil fuels displaced by the use of alternative fuels or less carbon intensive fossil fuels in the project plant (t CO ₂ /GJ)
Measuring frequency:	Continuously, aggregated at least annually
Reporting frequency:	Continuously, aggregated at least annually
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the registered VCS PD.

Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not Applicable
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The value is calculated as follows as the lowest of the following CO₂ emission factors: (a) The weighted average annual CO₂ emission factor for the fossil fuel(s) consumed and monitored ex ante during the most recent three years before the start of the project activity; (b) The weighted average annual CO₂ emission factor of the fossil fuel(s) consumed in the project plant in year y that are not less carbon intensive fossil fuels; (c) If F2 has been determined as the most likely baseline scenario: the weighted average annual CO₂ emission factor for the fossil fuel(s) that would have been consumed according to fuel mix determined in "Procedure for the selection of the most plausible baseline scenario and demonstration of additionality". The values are presented in the table in the Appendix 5 of the

	Verification Report.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$FC_{PJ,i,k,y}$ Quantity of fossil fuel type i fired in the project plant while project alternative or less carbon intensive fuel or biomass was used in year y (Litres/ton)
Measuring frequency:	The consumption is measured continuously through the use of mass or volume meters, crossed with operation logs showing when alternative of less carbon intensive fuel was used.
Reporting frequency:	The data is recorded continuously and aggregated at least annually.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	Mass or volume meters. The details have been provided in the Appendix 6 of the Verification report.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Yes
Calibration frequency /interval:	The monitoring equipment is calibrated according to calibration plan and/or shutdown plan of kiln. The documentation and calibration is controlled and managed in accordance with ISO9001 requirements

	/21/. The calibration details are provided under Appendix 5 of the Verification report.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	The monitoring equipment is calibrated according to calibration plan and/or shutdown plan of kiln. The calibration details are provided under Appendix 5 of the Verification report.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	The consistency of metered fuel consumption quantities is cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities is also cross-checked with available purchase invoices from the financial records.
How were the values in the monitoring report verified?	The values have been checked from the operation logs showing when alternative of less carbon intensive fuel was used. The data is cross-checked by an annual energy balance that is based on purchased quantities and stock changes /5/. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities is also cross-checked with available purchase invoices /5/ from the financial records. The values are presented in the Appendix 5 of the Verification report.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The documentation and calibration is controlled and managed in accordance with ISO9001 requirements /21/. The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
---------------------	------------------------

Data / Parameter: (as in monitoring plan of the VCS PD):	EF _{grid,CM,y} Combined margin emission factor for the grid in year y (tCO ₂ /MWh)
Measuring frequency:	Once during the monitoring period. This emission factor in this report is calculated using the Methodological Tool: "Tool to calculate the emission factor for an electricity system" (version 5.0) /22/. The data has been sourced from the latest National value reported published by Thailand Greenhouse Gas Management Organization. ³ /21/
Reporting frequency:	Once during the monitoring period. This emission factor in this report is calculated using the Methodological Tool: "Tool to calculate the emission factor for an electricity system" (version 5.0) /22/. The data has been sourced from the latest National value reported published by Thailand Greenhouse Gas Management Organization /21/.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected	Not Applicable

³<http://ghgreduction.tgo.or.th/tver-method/tver-calculation-data.html>

frequency represent good monitoring practice?	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	This emission factor (0.5637) in this report is calculated using the Methodological Tool: "Tool to calculate the emission factor for an electricity system" (version 5.0) /22/. The data has been sourced from the latest National value reported published by Thailand Greenhouse Gas Management Organization /21/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	TDL _{j,y} Average technical transmission and distribution losses for providing electricity to source j in year y.
Measuring frequency:	Annually The data has been sourced from the World Bank indicator 'Electric power transmission and distribution loss (%of output)' for Thailand ⁴
Reporting frequency:	Annually The data has been sourced from the World Bank indicator 'Electric power transmission and distribution loss (%of output)' for Thailand ⁵ /21/.
Is measuring and	Yes. From the document review and onsite verification, it is

⁴ <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=TH&page=6>

⁵ <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=TH&page=6>

reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the revised/registered VCS PD.
Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not Applicable
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	As per the option 1 of the applied tool: Use recent, accurate and reliable data available within the host country. The values have been sourced from the World Bank indicator 'Electric power transmission and distribution loss (%of output)' for Thailand ⁶ /21/.

⁶ <https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=TH&page=6>

Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.
---	---

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EC _{PJ,j,y} Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/year)
Measuring frequency:	Direct measurement or calculated based on measurements from more than one electricity meters in line with the VCS PD.
Reporting frequency:	Direct measurement or calculated based on measurements from more than one electricity meters in line with the VCS PD.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the registered VCS PD.
Type of monitoring equipment:	The monitoring equipment (Electricity meters /10/) details are provided in the Appendix 6 of the Report. The monitoring equipment details have been checked during the site visit and found consistent.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class of the Electricity meters /10/ is in compliance with the registered VCS PD. Hence accepted to the verification team.
Calibration frequency /interval:	The calibration frequency is in compliance with the registered VCS PD and hence accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the	Yes

VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	N/A
How were the values in the monitoring report verified?	As per the description of comment provided in Data/Parameter table 10 of the applied tool, option b is chosen , <i>Estimation of electricity consumption as highest daily value among the daily monitored values multiplied by the number of days' data were missing</i>. The reference of maximum data is provided in the Appendix 5 The reported values in the MR and ER sheet were found to be consistent with the monitored information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	FC i,j,y Quantity of fuel type i combusted in process j during the year (Litres/ton biomass)
Measuring frequency:	Not Applicable. Specific consumption figure which used for ex-ante estimation in the previous crediting period.
Reporting frequency:	Not Applicable. Specific consumption figure which used for ex-ante estimation in the

	previous crediting period.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes
Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not Applicable
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The value (0.4955) is based on the specific consumption figure which used for ex-ante estimation in the previous crediting period.
Does the data management (from monitoring equipment to emission reduction	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	
---	--

Monitored Parameter	Assessment/Observation								
Data / Parameter: (as in monitoring plan of the VCS PD):	NCV _{i,y} Weighted average net calorific value of fuel type i in year y (MJ/Litre)								
Measuring frequency:	The following data sources may be used if the relevant conditions apply: <table border="1"> <thead> <tr> <th>Data source</th><th>Conditions for using the data source</th></tr> </thead> <tbody> <tr> <td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr> <tr> <td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr> <tr> <td>(c) Regional or national default values</td><td>If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances)</td></tr> </tbody> </table> Option c) Regional or national default values, is chosen. The reference from reports of Department Alternative Energy Development and Efficiency /21/ is used. Appropriateness of the values is reviewed annually	Data source	Conditions for using the data source	(a) Values provided by the fuel supplier in invoices	This is the preferred source	(b) Measurements by the project participants	If (a) is not available	(c) Regional or national default values	If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances)
Data source	Conditions for using the data source								
(a) Values provided by the fuel supplier in invoices	This is the preferred source								
(b) Measurements by the project participants	If (a) is not available								
(c) Regional or national default values	If (a) is not available. These sources can only be used for liquid fossil fuels and should be based on well documented, reliable sources (such as national energy balances)								
Reporting frequency:	Appropriateness of the values is reviewed annually								
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequencies are inline with the monitoring plan of the revised/registered VCS PD.								
Type of monitoring equipment:	Not Applicable.								

Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not Applicable
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The values under a), b) and c) are verified to be within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines /21/. The summary of value has been provided in the Appendix 5 of the Verification report. The reported values in the MR and ER sheet were found to be consistent with the QIS (Quality Information System) information.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	EF _{CO₂,i,y} Weighted average CO ₂ emission factor of fuel type i in year y (tCO ₂ /GJ)
Measuring frequency:	Once during the monitoring period. The data is sourced from the “Option d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories is selected for this case” /21/
Reporting frequency:	Once during the monitoring period. The data is sourced from the “Option d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories is selected for this case” /21/
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	The data is sourced from the “Option d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories /21/ is selected for this case”
Type of monitoring equipment:	Not Applicable
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	Not Applicable
Calibration frequency /interval:	Not Applicable
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration,	Not Applicable

does the selected frequency represent good monitoring practice?	
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not Applicable
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The value (74.8) has been sourced based on the "Option d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories /21/ is selected for this case". The value from IPCC is applied for the most conservative approach.
Does the data management (from monitoring equipment to emission reduction calculation) ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

Monitored Parameter	Assessment/Observation
Data / Parameter: (as in monitoring plan of the VCS PD):	$FR_{f,m}$ Total mass of freight transported in freight transportation activity f in monitoring period m (Tonnes)
Measuring frequency:	Recorded continuously and aggregated at least annually in line with the VCS PD.
Reporting frequency:	Recorded continuously and aggregated at least annually in line with the VCS PD. The same was also verified during the on-site visit and found OK.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. From the document review and onsite verification, it is confirmed that the measuring and reporting frequency is inline with the monitoring plan of the revised/registered VCS PD.

Type of monitoring equipment:	The monitoring equipment details are provided in the Appendix 6 of the Report. The monitoring equipment details have been checked during the site visit and found consistent.
Is accuracy of the monitoring equipment as stated in the VCS PD? If the VCS PD does not specify the accuracy of the monitoring equipment, does the monitoring equipment represent good monitoring practice?	The accuracy class is in compliance with the registered VCS PD. Hence accepted to the verification team.
Calibration frequency /interval:	The monitoring equipment is calibrated /8/ according to calibration plan and/or shutdown plan of kiln which is in compliance with the registered VCS PD. The documentation and calibration is controlled and managed in accordance with ISO9001 requirements. Hence accepted to the verification team.
Is the calibration interval in line with the monitoring plan of the VCS PD? If the VCS PD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Yes
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Yes
If applicable, has the reported data been crosschecked with other available data?	Not Applicable
How were the values in the monitoring report verified?	The values mentioned in the monitoring report and ER sheet were verified with the Monitoring records. The summary of values has been provided in the Appendix 5 of the Verification report. The reported values in the MR and ER sheet were found to be consistent with the Monitoring records /5/.
Does the data management (from monitoring equipment to emission reduction calculation) ensure	The data management procedure is transparent; which ensure correct transfer of data and reporting of emission reductions.

correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	
---	--

Remaining Issues from Validation or Previous Verification:

From the review of validation reports and the previous (5th) verification report of the 1st crediting period, the verification team has found that there is no remaining FAR from validation/previous verification which is required to be addressed during this current verification of the project activity.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The verification team has reviewed the emission reduction (ER) spread sheet and checked all the formulae and found they are correct and inline with the monitoring plan of the revised/registered VCS PD and the applied monitoring methodology.

All the monitored parameters are described above in Section 4.1 of the Report. All the ex-ante parameters which are used in the calculation of emission reduction are presented in section 3.1 of the MR transparently. It is confirmed that all the ex-ante parameters have been correctly used in the emission reduction calculations.

Baseline emissions:

It is noted that the formula and calculation used for baseline emission calculations in the monitoring report and ER sheet is in compliance with the revised/registered VCS PD. The default values and data used in the monitoring report /01/ is in-line with the revised/registered PD/25/. Hence it is accepted.

Project Emissions:

It is noted that the formula and calculation used for project emission calculations in the monitoring report and ER sheet is in compliance with the revised/registered VCS PD. The default values and data used in the monitoring report /02/ is in-line with the revised/registered PD /11/. Hence, it is accepted.

Leakage:

The leakage has been discussed under Section 4.3 of the MR. It is noted that the formula and calculation used for leakage emission calculations in the monitoring report and ER sheet is in compliance with the revised/registered VCS PD. The default values and data used in the monitoring report /01/ is in-line with the revised/registered VCS PD/11/. The leakage emissions resulting from the project is zero and hence accepted.

The following are the ex-ante parameters used in the ER calculations which are in compliance with revised/registered VCS PD /11/:

Parameter	Description	Value	Unit
$FC_{i,x}$, $FC_{i,x-1}$, and $FC_{i,x-2}$	Quantity of fossil fuel of type i used in the project plant in year x , $x-1$ and $x-2$ where x is the year prior to the start of the project activity and i are the fossil fuel types used in the project plant in the three years prior to the start of the project activity.	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	ton
$FC_{BL,F3,i,y}$	Quantity of fossil fuel type i that would in the absence of the project activity be used in the project plant according to the selected baseline scenario F3 in year y	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	ton
$P_{clinker,x}$, $P_{clinker,x-1}$, and $P_{clinker,x-2}$	Production of clinker in year x , $x-1$ and $x-2$ where x is the year prior to the start of the project activity	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	ton
NCV_i	Net calorific value of fossil fuel types i where i is the fossil types used in the project plant in the three years prior to the start of the project activity.	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	GJ/ton
$EF_{CO2,FF,i}$	Weighted average CO_2 emission factor for fossil fuel type i where i are the fossil types used in the project plant in the last three years prior to the start of the project activity	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	tCO_2/GJ
$EF_{burning,CH4,k,y}$	CH_4 emission factor for uncontrolled burning of the biomass residue type k during the year y	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	$t CH_4/t$ biomass
$EF_{CO2,f}$	Default CO_2 emission factor for freight transportation activity f	As per the revised/registered VCS PD /11/ & Appendix 5 of Report	$g CO_2/t$ km
$D_{f,m}$	Return trip distance between the origin and destination of freight transportation activity f in monitoring period m	As per the revised/registered VCS PD /11/ &	Kilometres

		Appendix 5 of Report	
--	--	----------------------	--

According to the applied methodology, the conservativeness of the achieved emission reductions was checked and the calculations have been transparently provided in the ER sheet. The emission reductions are calculated as specified by the applied methodology, ACM0003 Version 08.0 /14/. The total emission reduction for the monitoring period calculated as stated below.

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2016 (01/04/2016 to 31/12/2016)	164,348	58,321	0	106,027
2017 (01/01/2017 to 30/06/2017)	124,058	35,294	0	88,764
Total	288,406	93,615	0	194,791

The detailed emission reduction calculation is presented in the ER spread sheet /02/. All the formulae and the calculation procedure were checked by the verification team. It was observed that the emission reduction was determined in a conservative manner.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

During the verification site visit, all relevant documents were checked to assess the correctness and quality of data submitted by the project participants, which are used to determine emission reductions.

All records needed for monitoring are archived in line with the requirements of the revised/registered monitoring plan and the deviation as described under Section 3.2 and 3.3 of the Verification report. No significant, lack of evidence and missing data were detected during onsite verification. Hence, the verification team confirms that the monitoring system ensures required quality of the monitoring system to ensure the quality of the monitored data. All internal data are subjected to QA/QC measures.

It was verified through onsite interviews that the plant's team involved in the monitoring of project activity is well experienced. Hence, the verification team concludes that competent staff is employed by the project proponent to carry out the relevant tasks with sufficient accuracy.

4.4 Non-Permanence Risk Analysis

Not Applicable to the project activity

5 SAFEGUARDS

5.1 No Net Harm

The project activity has no potential negative environment and social-economic impacts. Assessment team confirms it based on its on-site visit, document review and local & sectoral expertise.

5.2 Local Stakeholder Consultation

The stakeholder meeting process is described in the Section 6 of the registered VCS PD / Section 5.3 of the revised PD /11/ in detail and the process was validated during the registration of project activity under VCS. VCS validation report verified to confirm the same. Stakeholder groups were identified and informed through oral and written means. Further the verification team has interviewed the local stakeholders during the on-site visit for this verification and could not found any negative impact out of the project activity.

6 VERIFICATION CONCLUSION

KBS Certification Services Pvt. Ltd. has been contracted by 'South Pole Carbon Asset Management Ltd.' to undertake independent 1st periodic verification and certification of 2nd crediting period for the greenhouse gas (GHG) emission reductions reported from "Siam Cement Biomass Project", for the monitoring period 01/04/2016 to 30/06/2017 (including both the days).

The verification is based on the monitoring report and revised/registered VCS PD for this project activity. Our verification approach was based on the requirements as defined under the VCS Standard Version 3.7 /16/17/, Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive Board of UNFCCC.

The management of the "The Siam Cement Co., Ltd." and "South Pole Carbon Asset Management Ltd." is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project final Monitoring Report Version 03, dated 12/09/2018 /1/. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of 'The Siam Cement Co., Ltd.' and "South Pole Carbon Asset Management Ltd.". The development and maintenance of records and reporting procedures are in accordance with the final Monitoring report Version 03, dated 12/09/2018 /1/.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 01/04/2016 to 30/06/2017 based on the reported emission reductions in the final Monitoring Report Version 03 and dated 12/09/2018 /1/ for the same period.

As a result of the verification, the verification team confirms that:

- All operations of the project are implemented and installed as planned and described in the project description.
- The monitoring system is in place and functional.
- The installed equipment essential for generating emission reductions runs reliably.
- The GHG emission reductions are calculated without material misstatements in a conservative and appropriate manner.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

Verification period: From [01-04-2016] to [30-06-2017]

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
2016 (01/04/2016 to 31/12/2016)	164,348	58,321	0	106,027
2017 (01/01/2017 to 30/06/2017)	124,058	35,294	0	88,764
Total	288,406	93,615	0	194,791

Location: Faridabad
Date: 13/09/2018



Authorized Signatory: Kaushal Goyal
Designation: Managing Director
KBS Certification Services Pvt. Ltd.

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CL	Clarification request
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
DCS	Distributed Control System
DEDE	Department of Alternative Energy Development and Efficiency
DOE	Designated Operational Entity
EB	Executive Board
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas(es)
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
NCV	Net Calorific Value
PD	Power Density
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
SCG	Siam Cement Group

TGMO	Thailand Greenhouse Gas Management Organization
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCSA	VCS Association
VCS PD	VCS Project Design document
VCU	Verified Carbon Unit
VER	Verified Emission Reduction
VVS	Validation And Verification Standard for project activities
WJ	Work Journal

APPENDIX 2: REFERENCES

S. No.	Name of document	date
/1/	Draft Monitoring Report Final Monitoring Report	Version 01, dated 03/05/2018 Version 03, dated 12/09/2018
/2/	Draft ER sheet Final ER sheet	Version 01, dated 03/05/2018 Version 02, dated 22/08/2018
/3/	Extract of manual of all the major equipments and all meters/measuring instruments/devices clearly indicating their specifications/ technical details corresponding to the project activity. List of auxiliary drives along with their rated capacity	-
/4/	Operating License for the Plant All the Government approvals e.g. from local section and Ministry of Industry, Thailand. Operational permit.	-
/5/	Daily Reports & Work Journal (WJ) for the monitoring parameters. Stock change data for the monitoring parameters Clinker and Cement Production details along with the sales record. Purchasing invoice	-
/6/	Extract of operation and maintenance record Competency certificates of operators. Records of outage	-
/7/	Single line diagram corresponding to the project activity	-

	describing the monitoring points Flow Chart for the Biomass Transport Operation Manual of the Cement Kiln Plant Biomass preparation flow diagram Process flow details for the wood chipper, biomass transportation, biomass dryers, biomass conveyers, kilns, biomass feeder, Work instruction for the Kilns operation	
/8/	Calibration certificates for the instruments (including power meters, bomb calorimeters, truck scale, rice husk weigh feeder, Kiln feed feeder) used in the project activity covering this monitoring period	-
/9/	Study on Energy potential of utilized solid biomass during the monitoring period	-
/10/	Snap shots of the following Equipments: Covering the equipment and corresponding nameplates under project boundary (all major equipments). All the meters and measuring & testing equipment (including their specifications/nameplates).	-
/11/	Registered VCS PD for the project "Siam Cement Biomass Project" Revised VCS PD for the project "Siam Cement Biomass Project"	Version 3.1, dated 06/11/2009 Version 2.2, dated 03/01/2018
/12/	Bureau Veritas Certification Holding SAS: Validation report for the registered VCS PD "Siam Cement Biomass Project" KBS Certification Services Pvt. Ltd.: Validation report for the revised VCS PD "Siam Cement Biomass Project"	Dated 03/11/2009 Dated 28/12/2017
/13/	Bureau Veritas Certification Holding SAS: Verification report of the project "Siam Cement Biomass Project" for the 4th verification, Report ID BVC/VCS-VER/THAILAND-VR/07/2014 KBS Certification Services Pvt. Ltd.: Verification report of the project "Siam Cement Biomass Project" for the 5th	Dated 23/09/2014 Dated 04/09/2018

	verification, Report ID VCS.17.VER.011-MP-05	
/14/	CDM methodology: ACM0003 – “Partial substitution of fossil fuels in cement or quicklime manufacture”	Version 08.0
/15/	CDM-EB: Clean Development Mechanism Validation and Verification Standard for project activities	Version 01.0
/16/	VCS Verified Carbon Standard: VCS Program Guide, VCS Version 03, v3.7	21 June 2017
/17/	VCS Verified Carbon Standard: VCS Standard, VCS Version 03, v3.7	21 June 2017
/18/	VCS Verified Carbon Standard: VCS Verification Report Template Version 3.4	19 October 2016
/19/	VCS Verified Carbon Standard: VCS Guidance, Validation and Verification Manual, Version 3.2	19 October 2016
/20/	VCS Verified Carbon Standard: VCS Monitoring Report Template Version 3.4	19 October 2016
/21/	“Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual, Table 1-32 (for US heavy duty diesel vehicles, uncontrolled) IPCC: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, available at weblink http://www.ipcc-nggip.iges.or.jp/public/2006gl/ World Business Council for Sustainable Development at http://wbcsdcement.org/index.php/key-issues/climate-protection/co2-accounting-and-reporting Summary report: The study of emission factor for electricity generation of Thailand in year 2014, published by Thailand Greenhouse Gas Management Organization Thailand Alternative Energy Situation Report 2014, 2015, 2016 and 2017 from Department of Alternative Energy Development and Efficiency (DEDE). Thailand Grid Emission Factor for GHG Reduction Project/Activity” , published by TGO on 28/09/2017	-

	http://tver.tgo.or.th/2015/file/download/Grid_Emission_Factor_124.pdf ISO9001 requirements World Bank indicator 'Electric power transmission and distribution loss (%of output)' for Thailand https://data.worldbank.org/indicator/EG.ELC.LOSS.ZS?locations=TH&page=6	
/22/	CDM-EB: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", version 03.0 CDM-EB Tool: Project and leakage emissions from transportation of freight", version 01.1.0. "Guidelines on assessment of different types of changes from the project activity as described in the registered PDD (Annex 67 EB48)" Upstream leakage emissions associated with fossil fuel use", Version 02.0 Methodological Tool "Tool to calculate the emission factor for an electricity system" (version 05.0) Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion", version 03 Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion", version 03;	-

APPENDIX 3: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Personnel Name:		Chetan Swaroop Sharma	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒

Area(s) of Technical Expertise	
Sectoral Scope	Technical Area
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar
	TA 1.2: Energy generation from renewable energy sources
Energy Demand	TA 3.1. Energy demand
Waste handling and disposal	TA 13.1. Solid waste and wastewater TA 13.2. Manure
Approved by (Manager C & T)	Sanjay Kandari
Approval date:	01/05/2017

Personnel Name:		Rohit Badaya	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope	Technical Area		
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar		
	TA 1.2: Energy generation from renewable energy sources		
Energy demand	TA 3.1. Energy Demand		
Waste Handling and Disposal	TA 13.1 Solid waste and wastewater TA 13.2 Manure		
Approval date:	16/10/2017		

Personnel Name:		Anil Kumar Pandey	
Qualified to work as:			
Team Leader	☐	Technical Expert	☒
Validator/Verifier	☐	Financial Expert	☐
Technical Reviewer	☐	Local Expert (India)	☐
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy Industries (Manufacturing Industries)	TA 4.1: Cement		
Approved by (Manager C & T)		Sanjay Kandari	
Approval date:		10/07/2017	

Personnel Name:		SIAM PHOOLCHAROEN	
Qualified to work as:			
Team Leader	☐	Technical Expert	☐
Validator/Verifier	☐	Financial Expert	☐
Technical Reviewer	☐	Local Expert (Thailand)	☒
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
NA		NA	
Approved by (Manager C & T)		Sanjay Kandari	
Approval date:		11/11/2016	

Personnel Name:		Rajpal Singh Shekhawat	
Qualified to work as:			
Team Leader	☐	Technical Expert	☒
Validator/Verifier	☐	Financial Expert	☐
Technical Reviewer	☐	Local Expert	☐
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
4: Manufacturing Industries		TA 4.1: Cement Sector	
Approved by (Manager C & T)		Gagandeep Kakkar	
Approval date:		31/12/2014	

Personnel Name:		M.P. Kanal	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☐
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar TA 1.2: Energy generation from renewable energy sources	
Energy demand		TA 3.1. Energy Demand	
Waste Handling and Disposal		TA 13.1 Waste Handling and Disposal	
Agriculture		TA 15.1 Agriculture	
Approved by (Manager C & T)		Sanjay Kandari	

Approval date:	02/08/2017
----------------	------------

APPENDIX 4: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

Table 1. Remaining FAR from validation and/or previous verification

FAR ID	xx	Section no.	-	Date:
Description of FAR				
Project participant response				Date:
Documentation provided by project participant				
DOE assessment				Date:
Project participant response				Date:
Documentation provided by project participant				
-				
DOE assessment				Date:

Table 2. CL from this verification

CL ID	01	Section no.	-	Date: 27/08/2018
Description of CL				
PP is requested to submit the Biomass availability assessment for the current monitoring period.				
Project participant response				Date: 30/08/2018
As per the latest methodology, the biomass availability assessment is not required for the leakage emission calculation, please refer to the latest registered PD.				
Documentation provided by project participant				
-				
DOE assessment				Date: 30/08/2018
The latest methodology applied during this 2 nd crediting period has been checked and as per which the biomass availability assessment is not required for the leakage emission calculations. Further the same is also in line with the approved revised VCS PD and hence the issue is closed.				
Project participant response				Date:

Documentation provided by project participant	
DOE assessment	Date:

Table 3. CAR from this verification

CAR ID	01	Section no.	-	Date: 27/08/2018
Description of CAR				
1. PP is requested to submit the Calibration Certificates for the equipments involved during the monitoring period. 2. The calibration details provided in the Table 10 of the MR are of year 2013 and 2014. PP is also requested to provide latest calibration details (corresponding to the monitoring period) in the MR. 3. The Table-7 (Summary of Project Emissions calculations) of the Monitoring Report mentions the Project Emission calculations for the year 2006 and 2007, how both the years do not fall under the monitoring period. Similarly "ER cal_TS" spreadsheet of the "ERs Excelsheet" also indicate total emission reductions for the year 2006 and 2007, which do not fall under the monitoring period. Hence the PP shall provide appropriate corrections in the documents.				
Project participant response				Date: 30/08/2018
1. The calibration reports have been already provided for the previous verification. 2. The calibration detail in the latest version of MR is updated. 3. Both information is updated in the latest version of MR.				
Documentation provided by project participant				
-				
DOE assessment				Date: 30/08/2018
1. The calibration certificates of the equipments covering the monitoring period have been submitted to the verification team and found Ok. Hence the issue is closed. 2. The calibration details in the table 10 of MR have been updated in the revised Monitoring report considering the latest monitoring period under verification. Hence the issue is closed. 3. The project emission calculations have been updated in the table 7 of the revised Monitoring report considering the latest monitoring period under verification. Hence the issue is closed.				
Project participant response				Date:
Documentation provided by project participant				
-				
DOE assessment				Date:

Table 4. FAR from this verification

No FAR raised during this verification.

FAR ID	xx	Section No.		Date: DD/MM/YYYY
Description of FAR				
Project participant response				Date: DD/MM/YYYY

Documentation provided by project participant	
DOE assessment	Date: DD/MM/YYYY

APPENDIX 5: MONITORED & HISTORICAL DATA

Monitored data of Thung Song site

TS Type of fuel	2016			2017		
	Amount ton-AF	LHV GJ/ton	Heat GJ	Amount ton-AF	LHV GJ/ton	Heat GJ
<i>Clinker</i>	2,330,842			1,763,781		
<i>Running Hrs.</i>	6,922			6,922		
HFO+used oil	1,782	40.40	72,016	1,149	40.40	46,421
Coal	17,903	25.96	464,776	17,262	25.10	433,233
Coal HH	99,815	24.58	2,453,842	39,847	25.44	1,013,542
Coal MH	94,545	25.60	2,419,951	104,828	25.25	2,646,451
Coal Low Grade	4,004	23.97	95,982	1,434	24.26	34,788
Total	218,049	25.25	5,506,567	164,521	25.37	4,174,434
Rubber tire	9,977	31.13	310,604	2,536	31.49	79,854
RDF	108	20.58	2,213	153	28.23	4,318
RDF ECO	6,379	26.71	170,360	6,144	28.12	172,781
Total	16,463	29.35	483,177	8,834	29.09	256,954
50-wood cip	7,372	12.74	93,945	459	13.02	5,976
Saw dust	50,720	12.34	626,076	23,751	12.83	304,743
73-wood chip	5,198	10.06	52,295	9,666	10.02	96,891
Coconut dust	17,582	15.91	279,722	6,710	15.98	107,208
Charcoal	52	13.80	715			
Bark	42,845	11.41	488,743	48,666	11.71	569,763
Dust wood	4,744	12.43	58,982	8,665	12.54	108,624
Crushed bark	21,779	11.27	245,442	23,177	11.02	255,402
Total	150,292	12.28	1,845,920	121,095	11.96	1,448,606

Historical data of Thung Song site

Fuel Type		TS			
Fossil		2000	2001	2002	Total
Fuel Oil	ton-dry	4,126	3,291	2,486	9,903
Coal	ton-dry	188,136	166,152	143,493	497,781
Lignite	ton-dry	50,424	208,229	225,796	484,449
Pet-Coke	ton-dry	143,272	101,586	105,029	349,888
Anthracite	ton-dry	-	-	16,879	16,879
Heating Value		2000	2001	2002	Average
Fuel Oil	GJ/ton	40.39	40.39	40.39	40.39
Coal	GJ/ton	25.12	25.83	25.39	25.44
Lignite	GJ/ton	18.85	20.48	19.32	19.77
Pet-Coke	GJ/ton	33.98	32.81	32.22	33.11
Anthracite	GJ/ton			26.46	26.46
HG = FC x NCV	GJ	2000	2001	2002	Average
Fuel Oil	GJ	166,665	132,951	100,415	
Coal	GJ	4,726,725	4,292,170	3,643,295	
Lignite	GJ	950,726	4,263,615	4,363,495	
Pet-Coke	GJ	4,868,550	3,332,781	3,383,884	
Anthracite	GJ	-	-	446,680	
Pclinker	ton	3,381,254	3,797,506	3,825,211	3,667,990
HG/Pclinker	GJ/ton	3.17	3.17	3.12	
FC x NCV x EF		2000	2001	2002	Total
Fuel Oil	GJ	12,583	10,038	7,581	
Coal	GJ	438,640	398,313	338,098	
Lignite	GJ	86,421	387,563	396,642	
Pet-Coke	GJ	403,603	276,288	280,524	
Anthracite	GJ	-	-	42,256	
EFBL,CO2,y	tCO2/GJ	0.0879	0.0892	0.0892	0.0888

Summary of Baseline Emissions calculation

BE Step 1		2016	2017
$FC_{PJ,i,y} \times NCV_{i,y}$	GJ	5,506,567	4,174,434
$FC_{PJ,k,y} \times NCV_{k,y}$	GJ	2,329,098	1,705,560
$SEC_{clinker,PJ,y}$	GJ/t clinker	3.36	3.33
$SEC_{clinker,BL,y}$	GJ/t clinker	3.12	3.12
FP_y	GJ	561,541.49	375,564.88
FP_y (conservative)	GJ	561,541	375,565

BE Step 2		2016	2017
$\sum FC_{PJ,k,y} \times NCV_{k,y}$	GJ	2,329,098	1,705,560
FP_y	GJ	561,541	375,565
$EF_{BL,CO2,y}$ (option A)	tCO2/GJ	0.0888	0.0888
$EF_{BL,CO2,y}$ (option B)	tCO2/GJ	0.0925	0.0926
$EF_{BL,CO2,y}$ (option C)	tCO2/GJ	0.0888	0.0888
$BE_{FF,y}$	tCO2	156,943	118,091

BE Step 3		2016	2017
$\sum FC_{PJ,k,y}$	ton	150,292	121,095
$EF_{burning,CH4,k,y}$	tCH4e/t	0.001971	0.001971
GWP_{CH4}	tCO2e/tCH4	25	25
$BE_{CH4,B1/B3,y}$	tCO2	7,406	5,967

Summary of Project Emissions calculation

PE Step 1		2016	2017
$PE_{k,y}$		40,725	21,487

PE Step 2		2016	2017
2.1 Electricity			
$EC_{PJ,y}$	MWh	4,456	2,971
$EF_{grid,y}$	tCO ₂ /MWh	0.5637	0.5637
$TDL_{i,y}$	%	6.073%	6.073%
$PE_{EC,y}$	tCO ₂ e	2,664	1,776
2.2 On-site transportation			
Biomass residues	ton	150,292	121,095
$FC_{i,j,y}$	litres/ton	0.4955	0.4955
	litres/year	74,470	60,003
$NCV_{i,y}$	MJ/litre	36.42	36.42
$EF_{CO_2,i,y}$	tCO ₂ /TJ	74.8	74.8
$PE_{FC,y}$	tCO ₂ e	202.87	163.46
PE_y	tCO ₂ e	2,867.31	1,939.75

PE Step 3		2016	2017
$FR_{f,m}$	ton/y	150,292	121,095
$D_{f,m}$	km	400	400
$EF_{CO_2,f}$	gCO ₂ /t km	245	245
$PE_{TR,y}$	tCO ₂ e	14,729	11,867

APPENDIX 6: MONITORED EQUIPMENT DETAILS

Monitoring equipment at Thung Song site

Project Site	Meter Name	Type	Tag No.	Accuracy	Calibration History				
					2013	2014	2015	2016	2017
TS	WF-Biomass		228_92		23-Oct-13	19-Apr-14 10-Aug-14	2-Aug-15	4-May-16	22-Jul-17
TS	WF-Biomass		228_95		23-Oct-13	19-Apr-14 10-Aug-14	2-Aug-15	4-May-16	22-Jul-17 27-Jul-17
TS	WF-Biomass		6796-03		19-Sep-13	19-Mar-14 4-Sep-14	10-Feb-15 20-Oct-15	18-Jun-16	18-Sep-17 21-Sep-17
TS	WF-Biomass		6796-06		19-Sep-13	19-Mar-14 4-Sep-14	10-Feb-15 20-Oct-15	18-Jun-16	18-Sep-17 21-Sep-17
TS	WF-Biomass		K4J32		20-Jun-13	Kiln 4 stop			
TS	WF-Solid fuel	Coriolis	791-10	1%	23-Oct-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	WF-Solid fuel	Pfister	792-10	1%	23-Oct-13	29-Jul-14	24-Jul-15	22-Jul-16	22-Jul-17
TS	WF-Solid fuel	Pfister	793-10	1%	23-Oct-13	29-Jul-14	24-Jul-15	22-Jul-16	22-Jul-17
TS	WF-Solid fuel	Coriolis	6791-10	1%	10-Dec-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	WF-Solid fuel	Coriolis	6792-10	1%	10-Dec-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	WF-Solid fuel	Coriolis	6793-10	1%	10-Dec-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	WF-Solid fuel	Coriolis	K4J20	1%	21-Jun-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	WF-Solid fuel	Coriolis	K5J20	1%	21-Jun-13	29-Jul-14	24-Jul-15	25-Jul-16	22-Jul-17
TS	Truck scale	Mettler Toledo Model IND 310	BIX03 00461186FL	40 kg	13-Mar-13	11-Mar-14		24-Mar-16	
TS	Truck scale	Mettler Toledo Model IND 780	BIX04 B312160815	40 kg	27-May-13	11-Mar-14		24-Mar-16	27-Feb-17
TS	Truck scale	Mettler Toledo Model IND 560	XIX05 B211772421	40 kg	3-Apr-13	14-Jan-14		24-Mar-16	
TS	Truck scale	Mettler Toledo Model IND 780	XIX06 B308063872	40 kg	3-Apr-13	15-Jan-14		24-Mar-16	
TS	Bomb calorimeter	LECO AC-350	C-26		10-Feb-13 10-Aug-13	10-Aug-14 23-Dec-14	10-Feb-15 10-Aug-15	10-Feb-16 10-Aug-16	10-Feb-17 10-Aug-17
TS	Bomb calorimeter	LECO AC-500	C-25		10-Jan-13 10-Jul-13	10-Jan-14 10-Jul-14	10-Jan-15 10-Jul-15	10-Jan-16 10-Jul-16	10-Jan-17 10-Jul-17

Specific consumption of Biomass handling equipment

Machine	Fuel usage (Litre/hr.)	Capacity (ton/hr.)	Fuel consumption (Litre/ton)
1. Wood gripper 120 hp.	4	48.02	0.0833
2. CAT 966 220 hp.	23	168.62	0.1364
3. CAT 924 120 hp.	8	190.48	0.042
4. WA300 165 hp.	10	125.00	0.08
5. 10W Truck	5.5	35.76	0.1538

The electricity consumption of biomass transportation unit

kW Biomass Thung song plant					
	Nameplate cap	2005	2006	2007	2008
	kW	kWh	kWh	kWh	kWh
Wood chipper		1,929,200	1,705,680	1,410,120	2,020,480
Biomass Dryer		-	-	1,604,603	2,988,605
Biomass Transport					
- Supply +Star screen	20.7	151,243	148,899	158,006	153,318
- Transport TS4	18.1	84,344	117,854	112,617	120,617
- Transport TS5	35	237,669	251,761	267,159	243,645
- Transport TS6	56	409,160	393,254	406,785	414,773
Total Elec consumption	129.8	2,811,615	2,617,448	3,959,289	5,941,437